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Oscillator tunneling dynamics in the Rabi model ELINOR IRISH,
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— The familiar Rabi model (or single-mode spin-boson model), comprising a two-level system coupled to a quantum harmonic oscillator, continues to produce rich and surprising physics when the coupling strength becomes comparable to the individual subsystem frequencies. We construct approximate solutions for the regime in which the oscillator frequency is small compared to that of the two-level system and the coupling strength matches or exceeds the oscillator frequency. Relating our fully quantum calculation to a previous semi-classical approximation, we find that the dynamics of the oscillator can be considered to a good approximation as that of a particle tunneling in a classical double-well potential, despite the fundamentally entangled nature of the joint system. We assess the prospects for observation of oscillator tunneling in the context of nano- or micro-mechanical experiments and find that it should be possible if suitably high coupling strengths can be engineered.

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